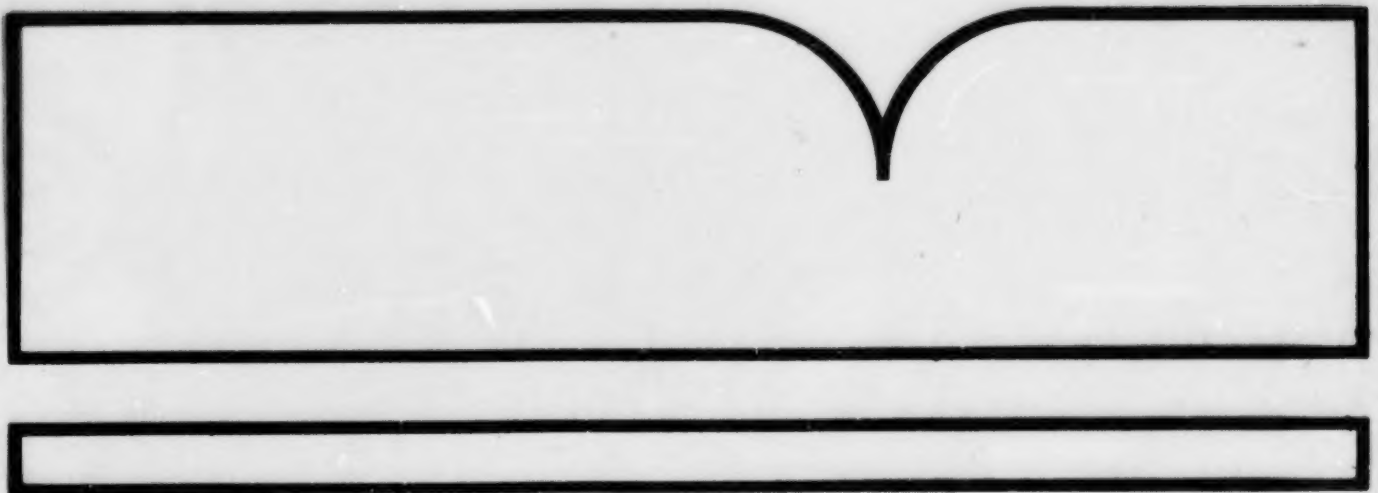


VALLEY Model
(Addendum/Supplemental Information)

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Research Triangle Park, NC

Dec 82



REPORT DOCUMENTATION PAGE		1. REPORT NO. EPA/DF-83/007b	2.	PB83-228890	
4. Title and Subtitle Addendum/Supplemental Information for the VALLEY Model				5. Report Date December 1982	
7. Author(s)				6.	
9. Performing Organization Name and Address EPA, Office of Research and Development Environmental Sciences Research Laboratory Meteorology and Assessment Division Mail Drop 80 Research Triangle Park, NC 27711				8. Performing Organization Rept. No.	
12. Sponsoring Organization Name and Address				10. Project/Task/Work Unit No.	
				11. Contract(C) or Grant(G) No. (C) (G)	
				13. Type of Report & Period Covered	
				14.	
15. Supplementary Notes					
16. Abstract (Limit: 200 words) This supplemental information on the VALLEY model is part of the documentation of the UNAMAP Version 5 package. It enables users to update their guide for this model. The coding changes documented in the report have already been made to the source code included as part of the UNAMAP Version 5 tape.					
17. Document Analysis a. Descriptors Atmospheric Sciences Diffusion Meteorology Models Atmospheric Pollution Simulation Air Pollution Algorithms b. Identifiers/Open-Ended Terms REPRODUCED BY NATIONAL TECHNICAL INFORMATION SERVICE U.S. DEPARTMENT OF COMMERCE SPRINGFIELD, VA 22161 c. COSATI Field/Group					
18. Availability Statement:			19. Security Class (This Report)		21. No. of Pages
			20. Security Class (This Page)		22. Price

December 1982

ADDENDUM/SUPPLEMENTAL INFORMATION

TO THE

VALLEY MODEL

The computer code modifications addressed herein are the complete set of changes made to date in the Valley Model code as it appears in the Valley Model User's Guide, EPA-4/2-77-018, September 1977. All modifications have been incorporated in the Valley code as part of the UNAMAP-5 available from the National Technical Information Service.*

Each item in this report is preceded by the date on which it was issued. MAIN designates the main program.

A. Computer Program Modifications

Make the following modifications to Appendix B of the Valley Model User's Guide. Note that the code line sequence numbers in the Subroutine EBPLT1 code of UNAMAP are 100 larger than those in the User's Guide; the latter are cited herein as in the original source code in the User's Guide.

1. 8/78 - Insert the following line of code in MAIN:
IF(TEMP.EQ.0.)TEMP=293.

MA021250

The original code caused all concentrations to be zero when conversion to standard conditions was specified.

2. 8/78 - Delete the following lines of code from Subroutine EBPLT1:

P=1.E+10
TEMP=1.E+10

PL023700
PL023800

The original code caused the ambient temperature and pressure to be incorrectly assigned very large values for the analyses of the second and successive STAR decks in a single execution of the program, resulting in concentrations that are obviously in error.

*All footnotes dated 12/82 identify corrections to this addendum only.
No modifications to the UNAMAP 4 or 5 VALLEY Code are required.

3. 7/79 - Replace lines MA046200 through MA046600 in MAIN with the following lines of code:

DUM3=-.5*((-H-DUM1)/SIGZ)**2	MA046150
DUM4=-.5*((H-DUM1)/SIGZ)**2	MA046155
IF(DUM4.LT.-40.)GO TO 68	MA046160
IF(DUM3.LT.-40.)GO TO 64	MA046165
DUM2=EXP(DUM3)+EXP(DUM4)	MA046170
GO TO 65	MA046175
64 DUM2=EXP(DUM4)	MA046180

This change precludes underflow diagnostics that may occur in some computer systems, but does not affect resulting concentrations.

4. 10/79 - Insert the following lines of code in MAIN:

NPASS=0	MA008505
SGRID=0	MA008510
IF(GRID.EQ.SGRID.OR.NPASS.EQ.0.OR.SUM.EQ.0.0) GO TO 72	MA013840
WRITE(6,71)	MA013845
71 FORMAT('1'////////' VALLEY DIAGNOSTIC.'/' BE AWARE THAT YOU HAVE CHMA013850	
AANGED THE VALUE OF GRID BELOW.'/' A RERUN IS REQUIRED UNLESS ALL RMA013855	
BECEPTORS OF CONCERN '/' LIE ON AN ELEVATED, FLAT PLANE.') MA013860	
72 NPASS=1	MA013865
SGRID=GRID	MA013870

These additions produce a warning of potential errors due to a possible oversight by the user. See page 3-2 (Section 3.1.4, first paragraph) of the Valley Model User's Guide.

5. 10/79 - Change the following line of code in MAIN to read:

IF(MWT.NE.0.0) GO TO 3220	MA020700
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6. 10/79 - In code line PL002500 of Subroutine EBPLT1 replace the literal data (i.e., ' VIA VALLEY VI') with 'VIA VALLEY VI 10/79'.

7. 10/79 - Insert the following line of code in EBPLT1:

REAL MWT	MA000790*
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8. 10/79 - Change the following code line of MAIN to read:

IF(IZBRIG.EQ.0) GO TO 15	MA041200
--------------------------	----------

Precludes division overflow in Subroutine BEH072.

9. 10/79 - Change the following lines of code in Subroutine EBPLT1 to read:

803 FORMAT(T9,'HLIFE=',F6.2,'HRS. {etc.})	PL011500
IF(W.EQ.0.0) W=1.E10	PL013300

*12/82 - Correct sequence ID number from MA000790 to PL000790.

10. 10/79 - Insert the following lines of code in Subroutine EBPLT1:

IF(TS(NSOR).EQ.1.E10) TS(NSOR)=0.	PL014750
IF(D(NSOR).EQ.1.E10) D(NSOR)=0.	PL014751
IF(VS(NSOR).EQ.1.E10) VS(NSOR)=0.	PL014752
IF(VF(NSOR).EQ.1.E10) VF(NSOR)=0.	PL014753
DO 11540 I=1,ISOR	PL016950
IF(GT(I).EQ.1.E10) GT(I)=0.	PL016951
IF(TS(I).EQ.1.E10) TS(I)=0.	PL016952
IF(D(I).EQ.1.E10) D(I)=0.	PL016953
IF(VS(I).EQ.1.E10) VS(I)=0.	PL016954
IF(VF(I).EQ.1.E10) VF(I)=0.	PL016955
11540 CONTINUE	PL016956

These changes preserve the proper values of the variables examined under two constraints: (1) more than one stability/wind (STAR) array is evaluated in a single job; and (2) the source-data records are, for convenience, input only once for the entire job. Without the recommended changes, concentrations for the second and successive STAR data sets are significantly underestimated -- only under the constraints just mentioned. The revised program code should be used to reexamine the second and successive STAR data sets evaluated in a single job with the original program code when DUPSOR, an input control parameter, was assigned a value greater than zero.

11. The following set of program changes must be made as a group.

12/80 - Delete the following lines of code from MAIN:

SIGZ=SQRT((A(LL)*ABS(XP)**B(LL)+C(LL))**2 + SIGI**2)	MA040500
IF(IZBRIG.EQ.0)GO TO 15	MA041200
IF(L.LT.5) GO TO 14	MA041300
H=HS+BRIG	MA042000

12/80 - Change the following lines of code in MAIN to read:

C ISOR,GT,HST,WT,VFORM,AXDIR,IUR,ISHORT,NN,MAP,RECHT,HFCTR,K,P,MWT,	MA001900
A HLFIE,ISHORT,IBID,I26,IFR	MA010500
73 FORMAT(F5.1,F7.0,F6.0,5I3,2F4.0,I3,3I1)	MA010600
* TS(IL),VS(IL),D(IL),VF(IL),IT,1.0,XXP,DTDZ(IT),TEMP,P,I26)	MA034000
CC SIGMA IS INCREASED FOR ALL LOW-LEVEL SRCS XCPT FOR RURAL STABLE.	MA040300
* TS(IL),VS(IL),D(IL),VF(IL),L,WS,XXP,DTDZ(L),TEMP,P,I26)	MA041700

12/80 - Replace the subroutine name "BEH072" with "BEHVAL" in lines MA033900 and MA041600 of MAIN.

12/80 - Insert the following lines of code in MAIN:

CC 1280 - OPTIONS ADDED FOR BUOYANCY INDUCED DISPERSION VIA SUM OF	MA000070
CC SQUARES OF PG SIGMA AND (DELTA H/3.5), AND FOR FACTOR 2.6 OR 2.4 IN	MA000080
CC STABLE PLUME RISE(FINAL) FORMULA, AND FOR SELECTIVE EXCLUSION OF	MA000090
CC TRANSITIONAL PLUME RISE. P AND T CHANGED FOR PPM.	MA000091
D IBID,I26,IFR	MA001910
CC IBID = 0 NO BUOYANCY-INDUCED DISPERSION.	MA013710
CC = 1 VALLEY WITH BUOYANCY-INDUCED DISPERSION.	MA013720
CC I26 = 0 MODEL USES 2.4 IN STABLE PLUME RISE EQ	MA013730
CC 1 MODEL USES 2.6 IN STABLE PLUME RISE EQ	MA013740
CC IFR = 0 TRANSITIONAL PLUME RISE AVAILABLE FOR ALL STABILITIES.	MA013750
CC = 1 NO TRANSITIONAL PLUME RISE.	MA013751
CC = 2 TRANSITIONAL RISE AVAILABLE FOR STABLE ONLY.	MA013752
IF(IFR.GT.0)XXP=0.	MA033711
IF(XXP.EQ.0.)BRIGUN(IL)=DUM5	MA034110
IF(IBID.EQ.0)GO TO 800	MA040410
SIGZ=((A(LL)*ABS(XP)**B(LL)+C(LL))**2 + SIGI**2)	MA040420
GO TO 9	MA040430
800 SIGZ=SQRT((A(LL)*ABS(XP)**B(LL)+C(LL))**2 + SIGI**2)	MA040440
IF(IZBRIG.EQ.0.AND.IBID.EQ.0) GO TO 15	MA041110
IF(IZBRIG.EQ.0.AND.IBID.NE.0) GO TO 802	MA041120
IF(L.LT.5.AND.IBID.EQ.0) GO TO 14	MA041130
IF(L.LT.5.AND.IBID.NE.0) GO TO 804	MA041140
XXP=XP/1000.	MA041535
IF(IFR.EQ.1)XXP=0.	MA041540
IF(XXP.EQ.0.)BRIG=DUM5	MA041750
IF(IBID.NE.0)GO TO 802	MA041910
H=HS+BRIG	MA041920
GO TO 15	MA041930
804 BRIG=BRIGUN(IL)/WS	MA041940
802 IF(G.GT.0.0)BRIG=G	MA041950
H=HS+BRIG	MA041960
DUM=BRIG/3.5	MA041970
DUM=DUM*DUM	MA041980
SIGZ=SQRT(SIGZ+DUM)	MA041990

12/80 - Change the following lines of code in Subroutine EBPLT1 to read:

DIMENSION TS(50),VS(50),D(50),VF(50),RECHT(112),KFIRI(8),NFIRI(8)	PL000900
DIMENSION VERBL (12),URBRUR(2),THREED(12),KBID(8),KCON(8),KBLK(8)	PL001000
C ISOR,GT,HST,WT,VFORM,AXDIR,IUR,ISHORT,NN,MAP,RECHT,HFCTR,K,P,MWT,	PL001600
C T27,F5.1,T93,F5.1,' VALLEY '/T2,'1280',	PL002500
D T60,F5.1,T102,6A4/T47,F5.1,T73,F5.1/T32,F5.1,T88,F5.1/	PL002600*
L T42,F5.1,T78,F5.1,/T5,8A4,T56,'0 KM',3X,F7.3,5('KM ',F7.3),'KM' /	PL005200
M T5,8A4,T56,6(']....+....'),']/T5,8A4,T60,F5.1,	PL005300
G V(68),V(54),V(77),V(49),V(61),V(69),V(55),(KFIRI(I),I=1,8),	PL014500
G S(68),S(54),S(77),S(49),S(61),S(69),S(55),(KFIRI(I)=1,8),	PL021700

*12/82 - Add this line of code to subroutine EBPLT1.

12/80 - Insert the following lines of code in Subroutine EBPLT1:

D IBID,T26,IFR	PL001610 *
DATA KCON/'BRIG','GS S','TABL','E CO','NSTA','NT I','S 2.',	PL002150
A '6. '/'	PL002155
DATA KBID/'BUOY','ANCY','IND','UCED','DIS','PERS','ION.',	PL002160
A ' '/'	PL002165
DATA KBLK/' ',' ',' ',' ',' ',' ',' '	PL002170
A ' '/'	PL002175
DATA KFIRI/'FINA','L RI','SE O','NLY','FOR','ALL','CAS',	PL002176
A 'ES. '/'	PL002177
DATA NFIRI/'ONLY','FIN','AL R','ISE ','FOR ','NONS','TABL',	PL002178
A 'E. '/'	PL002179
IF(IFR.EQ.1)GO TO 509	PL010214
IF(IFR.EQ.2)GO TO 502	PL010215
DO 501 I=1,8	PL010216
KFIRI(I)=KBLK(I)	PL010219
501 CONTINUE	PL010222
GO TO 509	PL010225
502 DO 503 I=1,8	PL010228
KFIRI(I)=NFIRI(I)	PL010231
503 CONTINUE	PL010234
509 CONTINUE	PL010237
IF(IBID.NE.0)GO TO 500	PL010250
DO 510 I=1,8	PL010255
KBID(I)=KBLK(I)	PL010260
510 CONTINUE	PL010265
500 IF(I26.NE.0)GO TO 520	PL010270
DO 525 I=1,8	PL010275
KCON(I)=KBLK(I)	PL010280
525 CONTINUE	PL010285
520 CONTINUE	PL010290
* (SCALE(N1),N1=1,6),(KCON(I),I=1,8),(KBID(I),I=1,8),	PL014550
* (SCALE(N1),N1=1,6),(KCON(I),I=1,8),(KBID(I),I=1,8),	PL021710
DO 3805 I=1,8	PL022450
KCON(I)=KBLK(I)	PL022451
KBID(I)=KBLK(I)	PL022452
KFIRI(I)=KBLK(I)	PL022453
3805 CONTINUE	PL022459

12/80 - Change the subroutine name "BEH072" to "BEHVAL" in Subroutine BEH072 line BE000100. This subroutine will hereafter be referred to as "BEHVAL."

12/80 - Change the following lines of code in Subroutine BEHVAL to read:

1 KST,U,X,DTHDZ,T,P,I26)	BE000200
DHA = PRC*(F/(U*S))*0.333333	BE010300

*12/82 - Change this line of code to read:

D IBID,I26,IFR	PL001610
----------------	----------

12/80 - Insert the following lines of code in Subroutine BEHVAL:

```
C BEHVAL - BEH072 WITH OPTION TO PERMIT 2.4 OR 2.6 AS COEFFICIENT      BE000298
C IN STABLE FINAL PLUME RISE EQN. X =0 FORCES FINAL RISE, AS IN BEH072 BE000299
  PRC=2.4                                                                BE005150
  IF(I26.NE.0)PRC=2.6                                                  BE005151
```

These changes permit the user to optionally designate treatment of the effects of buoyancy-induced dispersion (BID), to designate whether the program will assign the constant coefficient in the final stable plume-rise equation a value of 2.4 or 2.6, and to designate conditions for the use of transitional plume rise. See Section B below for discussion of the options. They also allow for the continued identification of the revisions made to the Valley Model computer code.

The use of the optional constants for the plume-rise formula are self-explanatory. Briggs' latest recommendation is to assign the constant a value 2.6.

Default is zero in all cases, and such default relegates the analysis to that controlled by the original Valley code. Statements are printed in the output indicating when the new options have been invoked.

12. Make the following modifications to MAIN:

12/80 - In statement MA009000 delete "OR TO PPM."

12/80 - In statement MA009300 change "CHI IS AT AMBIENT COND." to "CHI (UG/M3 ONLY) IS AT AMBIENT COND."

12/80 - In statement MA012300 change "TEMP/(MWT*P)" to "298./(MWT*1013.2)".

12/80 - Delete statements MA012400 and MA012600.

12/80 - Change the following line of code to read:

```
ALWT=8.31E04*298./(MWT*1013.2)                                         MA021900
```

These modifications describe and assure the proper values of temperature and pressure used in the conversion from $\mu\text{g}/\text{m}^3$ to ppm. Concentrations in ppm generated by the original computer code can be in error by up to about + 15 percent in rare cases, but most often the error would be near zero.

13. 12/80 - Change the following lines of code in Main to read:

```
3420 IF(PLHT.GT.0.0) GO TO 3430                                         MA043500
      IF(PLHT.LE.-400.0) GO TO 99                                       MA043700
      WS=WS*(400./(400.+PLHT)                                           MA043800
3430 IF(PLHT.LT.10.0) PLHT=10.                                         MA044000
```

These changes eliminate insignificant positive errors in calculated concentrations. The largest of these errors occurred at receptors no more than 10 m below the undisturbed plume centerline elevation.

B. Text Corrections to the Valley Model User's Guide

1. 8/78 - Page 3-2, line 5: Change 293 to 298.
2. 10/79 - The discussion of lateral plume deflection on Page 2-2, last paragraph, is incomplete. A statement to further define the treatment of emissions from very low heights during stable conditions is as follows: "The height-dependent attenuation factor for concentrations on elevated terrain is not applied to contributions from any stable plume with an undisturbed height of 10 m or less above stack base."

3. 10/79 - Page 3-1, Section 3.1.1, insert the following:

No attempt should be made to force alignment of the printed concentrations exactly on 16-point radials from map center or exactly on circles about map center. Consider, for example, the first printed concentration from center about the southwest direction. The decimal point lies 9.8 print spaces from center at a bearing of 227.5 degrees from center (using graphical techniques). With the variable GRID equal to 100 m, the distance of this receptor from center of the plot is 980 m. This receptor does not lie exactly on the southwest radial (225 degrees), nor does it lie on a circle about center that passes through, say, the first receptor to the west of center. The latter lies 8 print spaces from center, or, for this example, 800 m from center. Hence, the printed concentration decimal point represents, without relocation, the geographical position of a receptor in the real world.

4. 12/80 - Page 1-9, add the following lines to the list in Section 1.4.4:

- BUOYANCY-INDUCED DISPERSION
- COEFFICIENT 2.4 OR 2.6 IN FINAL STABLE PLUME-RISE EQUATION
- TRANSITIONAL AND/OR FINAL PLUME RISE

5. 12/80 - Page 2-4, Equation 2.1, and page 2-7, Equation 2.1a:

Change h to h_0 .

6. 12/80 - Page 2-5, last line: Change

" $T/(MP)$ " to " $298./(M-1013.2)$ ".

7. 12/80 - Page 2-6: Delete lines 2 and 4 (i.e., definitions of T and P).

12/80 - Page 2-8, last line of Section 2.1.3: Delete "during $S \leq 4$ " and insert "except that SIGI is set to zero during stable conditions in the rural mode. The vertical dispersion coefficient can be adjusted internally, at the user's discretion, for buoyancy-induced dispersion so that the net coefficient becomes

$$\sigma_z = \{(ax_p^b + d)^2 + \text{SIGI}^2 + (\Delta h/3.5)^2\}^{1/2}$$

where Δh is either the calculated or user-assigned plume rise at the receptor of concern."

9. 12/80 - Page 2-8, next to last line: Insert as a reference "1975." Also, add to list of references on page 5-1 the following paper by Briggs:

_____, 1975: Plume Rise Predictions. Lectures on Air Pollution and Environmental Impact Analysis. September 29 - October 3, 1975, Boston, Massachusetts. D. A. Haugen, Workshop Coordinator. AMS, Boston. pp59-104.

10. 12/80 - Insert the following at bottom of page 2-8:

The user may designate a value of 2.4 or 2.6 for the constant coefficient in the final plume rise equations for stable conditions. The value 2.6 is consistent with other EPA models. The user also selects one of three techniques which cause the program to invoke the use of : (1) the original code, which selects the lesser plume rise from the transitional and final rise formulae for all stabilities; or (2) only the final rise formula for all stabilities; or (3) only the final rise formula for nonstable conditions and the lesser result from both formulae for stable conditions. The second of these three techniques affords consistency with other EPA models; the third may be preferred for sources near elevated receptors.

11. 12/80 - Page 2-12, line 3: Delete "made."

12. 12/80 - Page 2-14, replace lines 8 through 12 with the following:

cloudy conditions, and can exist in both the daytime and nighttime. In rural areas the afternoon mixing height is halved in the Valley Model, and in urban areas it is averaged with the nighttime mixing height, for 40 percent of the class $S = 4$ occurrences. The remaining 60 percent of the neutral class (urban or rural) utilizes the mean afternoon mixing

13. 12/80 - Page 2-16, seventh line from bottom, delete the phrase "for the long-term option only,"

14. 12/80 - Page 3-9, last line, add the following:

An input value of zero (or blank) in effect defaults to infinity for the calculations, and is printed as 999.99 in the output.

15. 12/80 - Page 4-15, in @HDG card, replace the comma between X and M with a period.